

Industry's toxic bane to atmosphere



friends on earth

The past century has witnessed a tremendous growth in the industrial technology worldwide. This revolution has been the root for a multitude of problems that berate humans and other life forms. Foremost of them is global warming caused by the emission of fumes and gases from thermal power plants, exhaust gases from diesel automobiles and toxic gases from chemical industries that contain CO₂, O₃, NO_x, SO_x and PM. This fact conveyed to the world leaders by the ecological scientists at the earth summit in Rio has led to the development of new technology to reduce the emission of the above gases.

Global Warming

Mother earth helps to sustain life by absorbing the sun's rays that help act as a catalyst for various biochemical processes. As we know from our rigorous science lessons, one such process is photosynthesis where plants in the presence of sunlight and chlorophyll convert the carbon-dioxide from the atmosphere into starch and the oxygen that we respire. The presence of at least 20% oxygen in air is imperative for the survival of the ever increasing living beings on earth.

But the increase in pollutants and the blatant destruction of evergreen forests, especially the Amazon forests known as the lungs of earth has drastically reduced photosynthesis and disrupted the composition of clean air.

The largest forest of our planet containing 1/5 of all fresh water, home to 1/4 of all species, 5-10 million types of flora and fauna -this treasure is being destroyed. At first they bring saws after the saws come the fire after the fire, cattle and plantations in place of 10 million species. Industry, waste and megacities amidst the jungle! every minute an area as large as 10 football fields is destroyed to turn the resources into money.

In addition toxic fumes result in suffocation, asthma bronchitis, skin diseases, eye problems and cancers in flora and fauna.

(Health Aspects of Air Pollution with Particulate Matter, Ozone and Nitrogen Dioxide- Report on a WHO Working Group Bonn, Germany –2003)

The presence of heavy metal particulate matter in air prevents the cooling action at night and thus increases global warming. This results in the melting of the arctic and Antarctic icecaps and lead to the submersion of coastal areas.

Decisions enacted to reduce global warming

- 1) Levying carbon tax to countries that fail to reduce their co₂ emission from automobiles and industries.
- 2) Promote afforestation.
- 3) Utilizing green technologies that reduce emission of gases that induce global warming.

One such solution is the transition from sub critical power plants that have excessive carbon emissions to super critical power plants that filters and extracts nitrogen, sulphur and unburned carbon from the exhaust flue gases and burns them in their respective gas turbine units and produce additional MW. Ever since 1990 many MNCs have designed '*once through super critical boilers*' that utilize less coal and produce more energy.

Best MNC's with super critical boiler technology

1	Benson siemens	Germany
2	Sulzer	Switzerland
3	Bobcock &Wilcox	America
4	Foster & Wheeler	America
5	Alstom	America
6	Hitachi power systems	Japan
7	Mitsubishi	Japan
8	Toshiba	Japan
9	Technopromo Export	Russia
10	OJSC	Russia

The planning commission of India decided to install 72,330MW thermal power in its 11th and 12th plan and that a majority of them have to be super critical power plants. As per this many super critical plants are under construction of which 9 are operational.

Chinese, Korean and Russian power plant manufacturers in technological collaboration with MNC's have designed super critical power plants as shown by the following table.

	Producer/Ownership	State	Capacity
1	Technoprom export(OJSC), Russia / NTPC	Bihar, Chattisgarh	3 x 660 MW (TG) 3 x 660 MW(B&TG)
2	Harbin, SEPCO, BSTG, Bobcock, Shangai electric - China / Reliance power, Essar, Lanco infratech	Gujarat, Andra pradesh, Haryana, Maharashtra, Chattisgarh, Jharkand, Odisha, Madhya Pradesh	2 x 660 MW (B) 40 x 660 MW(B&TG)
3	Toshiba – Japan, / TATA power, JSW, NTPC, Essar	Gujarat, Karnataka	2 x 660, 5 x 800, 3 x 800 MW (TG)
4	Doosan heavy inds – Korea / TATA power, NTPC	Chattisgarh, Gujarat, Karnataka	3 x 660, 5 x 800, 3x800 MW (B)
5	L&T-MHI / Jaypee associates, Mahagenco, APgenco, KPCL, NTPC	Maharashtra, Madhya Pradesh, Andra Pradesh	5 x 660 MW(B&TG) 2 x 800 MW (TG)
6	Hitachi – Japan / BGR energy, NTPC	Maharashtra, Bihar, Uttar Pradesh, West Bengal, Chattisgarh, Odisha, Karnataka	6 x 660 MW (B) 5 x 800 MW (TG)
Total			31680 MW(B&TG) +13660 MW(B) +15300 MW(TG)

Super Critical power plants produced by BHEL in India

	Place / Ownership	State	Capacity
1	Bhar NTPC	Bihar	2 x 660 MW(B& TG)
2	KrishnaPattnam APGENCO	Andra Pradesh	2 x 800 MW(B)
3	Bhara JP Associates	Uttar Pradesh	3 x 660 MW(B& TG)
4	Lalithpur Bajaj groups	Uttar Pradesh	3 x 660 MW(B& TG)
5	Yeramarus KPCL	Karnataka	2 x 800 MW(B& TG)
6	Edlapur KPCL	Karnataka	1 x 800 MW(B& TG)
7	Bellary KPCL	Karnataka	1 x 700 MW(B& TG)
8	Singrauli D.B powers	Madhya Pradesh	2 x 660 MW(B& TG)
Total			9,700 MW(B&TG) +1600 MW (B)

BHEL, a pioneer in boiler manufacture in India, in collaboration with Alstom - USA, Benson Siemens – German has been installing (660MW, 800MW) Super Critical power plants.

The flow of water at high pressure (260 Bar) through the spiral-wound evaporator tubing maintained at a stifling 1300⁰C temperature by the combustion of coal in the vertically tubed furnace results in evaporation and after successive stages a high temperature, high pressure super critical fluid (260 Bar, 580⁰C) that mechanically rotates the shaft of steam turbines that drive the electromagnetic dynamo (generator) to generate electricity.

The risks of cracks and meltdown of boiler tubes due to high pressure, temperature and speed over years of operation is minimized by an alloy that forms the heart of this technology.

What is that alloy?

The ferritic or austenitic alloy of chromium, molybdenum, nickel, cobalt, boron and other heavy metals in iron with its high temperature and pressure resistant characteristics is used to manufacture boiler tubes weighing thousands of tons. Numerous hazards are faced by the workers who weld (Gas Tungsten Arc Welding at 4000⁰ c) the alloy by preheating at 350⁰ C and later normalize, harden and temper for hours at 500⁰ - 700⁰ C in LPG furnaces. Super critical boiler technology helps reduce global warming and the emission of PM and harmful gases like Co₂, No_x, So_x. Ironically the manufacture of super critical boilers in the power equipment production industries results in the emission of the same. These gases spread in the atmosphere and affect the flora and fauna within 10km radius from the industry. Skin problems, lung disorders, and various cancers are the adverse effects of these harmful gases on humans (WHO/IARC/Monograph volume 49,86,100C). Every year an average of 70 kg co₂, No_x, So_x, chromium VI and other PM is released to the atmosphere by a welder. To prevent this federal agencies like OSHA (Occupational Safety and Health administration) and EIA have stipulated that fume extractors have to be installed in the welding points and the filtered extracts have to be stored in airtight bags and kept track of for accounting the accumulated hazardous waste. NASA (USA), Iran and other countries are researching ways to make these poisonous waste biodegradable.

BHEL, Trichirappalli, TamilNadu manufactures super critical boilers' steam generators day and night with the tireless effort of around 1500 talented welders, more than 5000 fitters, 2500 supervisors and engineers. Every year P/T 91,92 (ASTM A335 / A335M, ASTM A213 / A213M) ferritic and austenitic alloys weighing 5 lakh metric tons are imported from developed nations for the manufacture 660/800 MW super critical steam generators and around 180 tons of poisonous fumes are released into the atmosphere during the welding process. The long lines of trucks that deliver the raw material and transport the finished components are a sight to behold in this industrial city. A tangible metallic smell is omnipresent in the locality. It's unfortunate that an ISO 9000, OHSAS 18001 certified company with an annual turnover of 150 billion INR has been tardy in setting up fume extractors, portable UV and x-ray shields and in providing air supplied respirators, fire retardant welding suits and other hi-tech safety equipment to ensure a safe working environment to its employees. This might be due to their tight schedules & targets and their innocent lack of knowledge about the OSHA final rules (02/28/2006) on Occupational Exposure to Hexavalent Chromium (**Fed Register #:** 71:10099-10385, **Standard Number:** 1910; 1915; 1917; 1918; 1926). Hopefully the prestigious receiver of **Golden Peacock Award 2011 for Occupational Health and Safety** will live up to its standards.

Preventive measures against toxic air

- 1) Use a Nano fabric dust mask (HEPA & ULPA) to filter submicron and prevent initial stage cough, cold, stomach problems, cancer at chronic stages and nervous disorders due to the inhalation of toxic air.
- 2) Utilize safety glasses that can prevent cataract and protect our eyes from heat rays, harmful UV radiation and toxic PM.
- 3) Use sunscreen & Aloe-Vera creams to prevent dermatitis and other skin diseases caused by particulate matters that include chromium (V1) and cobalt.
- 4) Use FR uniforms with nano charcoal bamboo apparels to protect skin from heat rays, harmful UV radiation and toxic PM.
- 5) Physical exercises, pranayama and a refreshing bath twice a day will also be productive
- 6) Consume a balanced diet and herbs prescribed by siddha medical system.



Welding fume extractor



Once Through Super Critical Power plant's steam generator

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Eco friendly Super Critical power plant